

The sense organs enable us to be aware of the conditions of our external as well as internal environment.

Eyes	– Light
Ears	– Sound
Tongue	– Taste
Nose	– Smell
Skin	– Touch

**Receptors** - The actual sensation is perceived by the sensory cells located in these organs - such cells

## RECEPTORS

Receptor is any specialized tissue or cell sensitive to a specific stimulus.

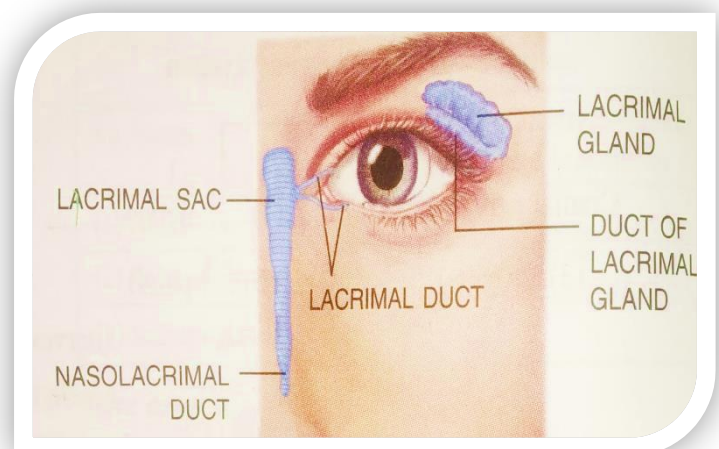
- (i) **Mechanoreceptors** - are receptors for touch, pressure of skin due to mechanical change.
- (ii) **Chemoreceptors** - receptors of taste of the tongue and smell of the nose due to chemical influences
- (iii) **Photoreceptors** - are rods and cones of the retina of eye due to light.
- (iv) **Thermoreceptors** are heat and cold receptors in the skin, due to change in temperature.
- (v) **Phonoreceptors** - receptors for sound/hearing.

## THE EYES

**Orbits:** The two eyes are located in deep sockets or orbits on the front side of the head.

**Eyelids:** protect the outer surface of the eyes and can shut out light.

**Eyebrows:** prevent the rain drops or the trickling perspiration from



getting into the eyes.

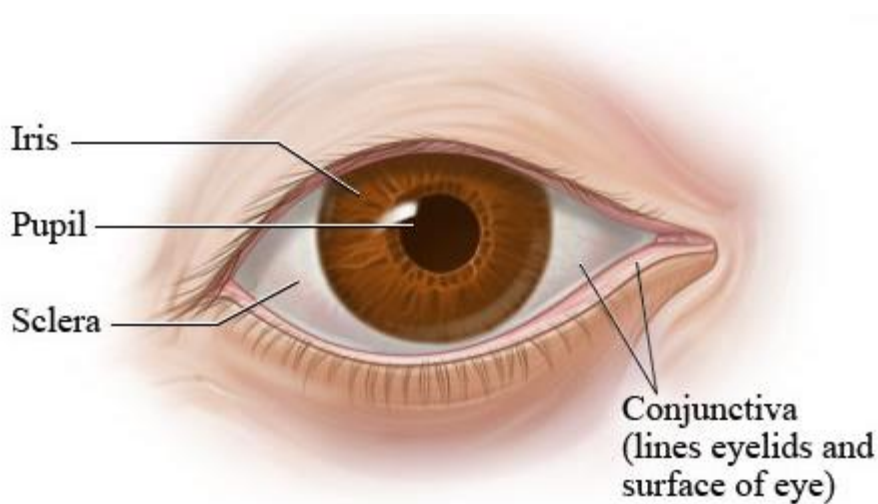
**Tear glands**(Lacrimal glands): They are located at the upper sideward portion of the orbit.

**Tear ducts:**

A nasolacrimal duct conducts the secretion into the nasal cavity.

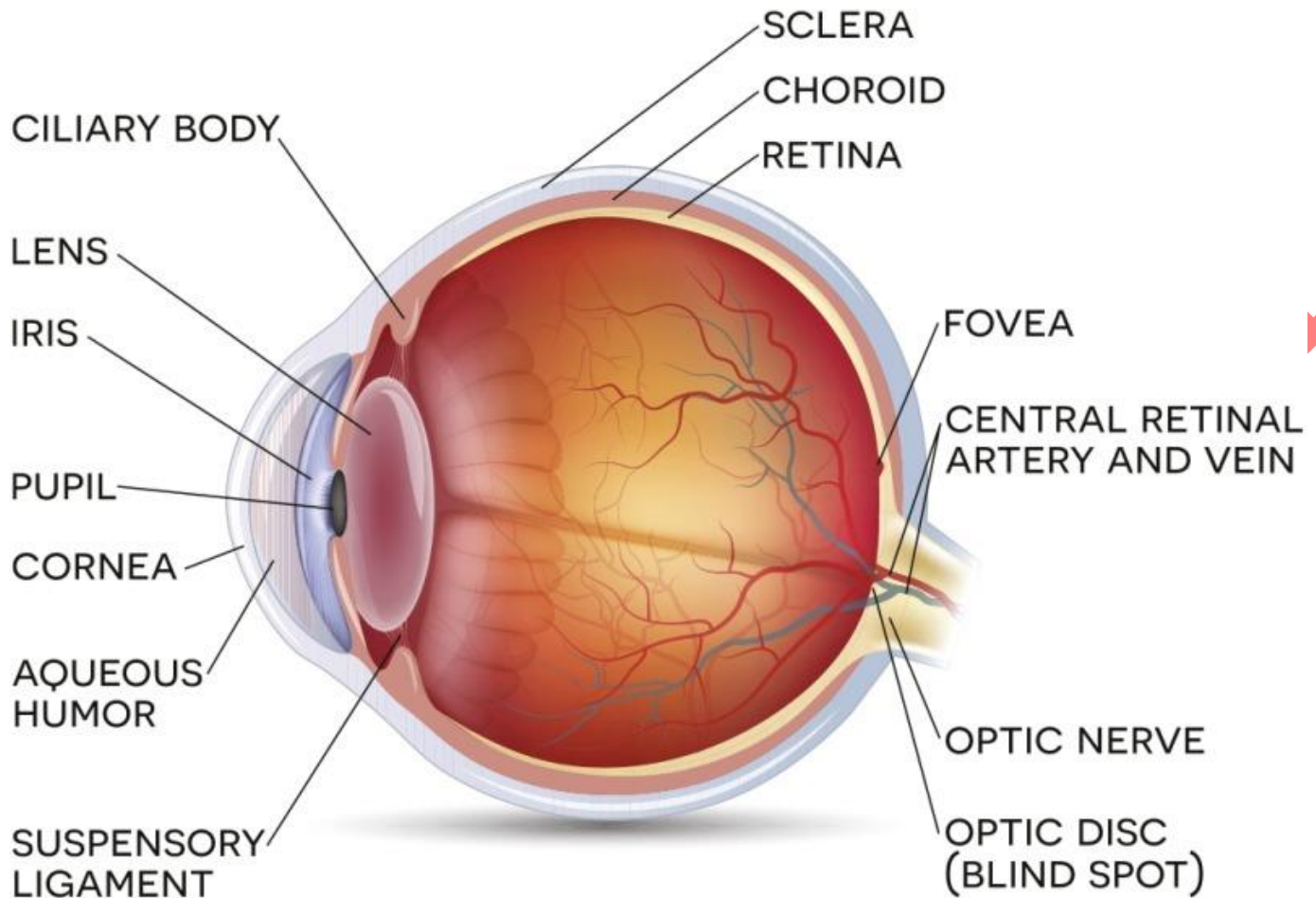
**Functions of Tears:**

1. Lubricate the surface of the eye
2. Wash away dust particles
3. Help in killing germs as it contains lysozyme.
4. Communicate emotions



**Conjunctiva:**

It is a thin membrane covering the entire front part of the eye. It is continuous with the inner lining of the eyelids. **"conjunctivitis"** : very common eye disease in which this outermost layer turns red due to a viral infection.



### Structure of the Eyeball:

- (1) outer **sclerotic**-White, fibrous-Cornea- Front colored part of eye
- (2) middle **choroid**-blood supply provide nourishment. **Iris** partially cover lens and leave a circular opening called **pupil**, which controls the amount of light.
- (3) inner **retina**- Rods(dim) and Cones (Color)

**(1) The sclerotic layer (or sclera)** : It bulges out and becomes transparent in the front region where it covers the coloured part of the eye; this part is called **the cornea**.

**(2) The choroid layer** contains a dark black pigment (melanin) which prevents light rays from reflecting and scattering inside the eye. In the front of the eye, the choroid expands to form **the ciliary body** (containing circular muscles which changes the shape of the lens).

The **iris** is also an extension of the choroid, partially covering the lens and leaving a circular opening in the centre, **the pupil**. The blue, brown or black colour of the eye refers to the colour of the iris.

The iris contains **radial muscles** to widen and circular muscles to constrict the pupil, This adjustment of the size of the pupil regulates the amount of light entering the eye.

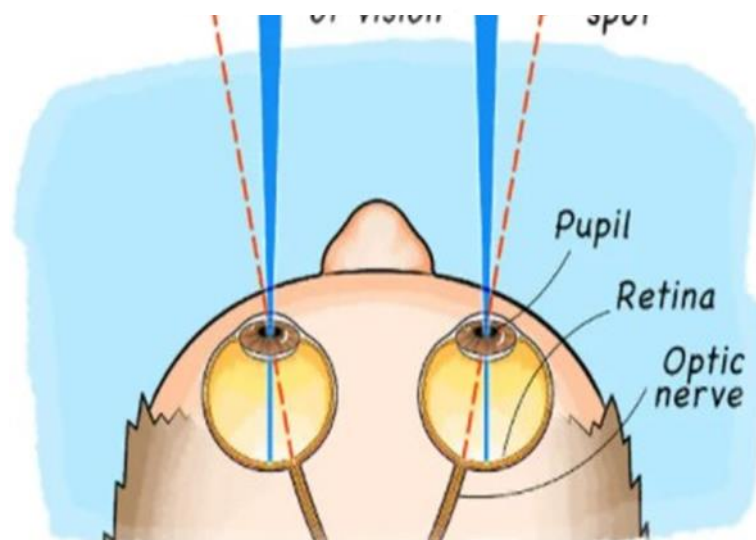
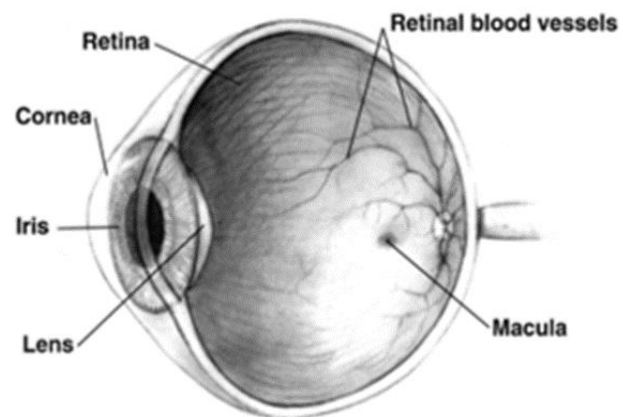
**(3) The retina** or the innermost layer is sensitive to light. It contains two types of sense cells called rods and cones.

- The *rod cells* are sensitive to dim light but do not respond to colour. They contain the pigment **rhodopsin or visual purple**.
- The *cones* are sensitive to bright light and are responsible for colour vision. They contain the **pigment iodopsin or visual violet**. The cone cells are mostly confined to the yellow spot.

### **YELLOW SPOT - The area of best vision**

A particular spot called the **macula lutea** or **yellow spot** lies at the back of the eye. This spot contains the maximum number of sensory cells and particularly the cones. It is the region of brightest vision and also of the colour vision.

**Yellow spot is the place of best vision of normal eye. This is the reason why we move our eyes from word to word as we read a line through a printed page.**



## BLIND SPOT - The area of no vision

Lateral to the yellow spot on the nasal side is the blind spot. There are no sensory cells here and, therefore, this is the **point of no vision**.

## LENS

The lens is a transparent, flexible, **biconvex crystalline** transparent body located just behind the pupil. The lens is collectively held in position by fibres called the **suspensory ligament**, which attaches it to the ciliary body. **The ciliary body** contains muscles which on contraction and relaxation, change the shape of the lens for viewing objects at different distances.

## TWO CHAMBERS OF THE EYE AQUEOUS AND VITREOUS CHAMBERS

The lens divides the inner cavity of the eyeball into two chambers:

**(1) Aqueous chamber** is the front chamber between the lens and the cornea. It is filled with a clear watery liquid called aqueous humour. The aqueous humour serves in two ways:

(i) Keeps the lens moist and protects it from physical shock,

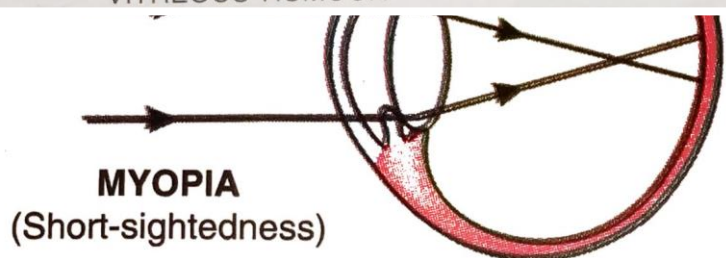
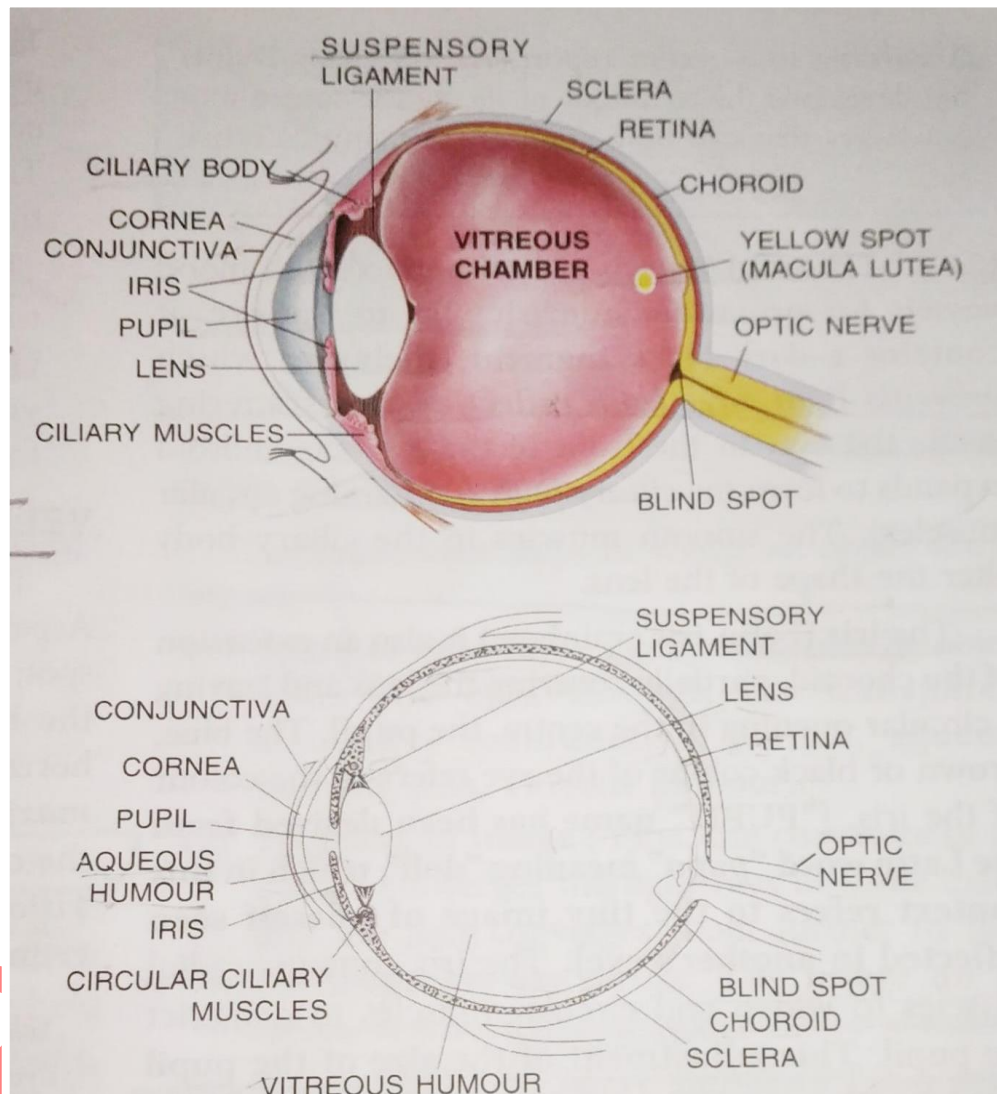
(ii) It refracts light.

**(2) Vitreous chamber** is the larger cavity of the eyeball behind the lens. It is filled with a transparent jelly-like thicker fluid called vitreous humour

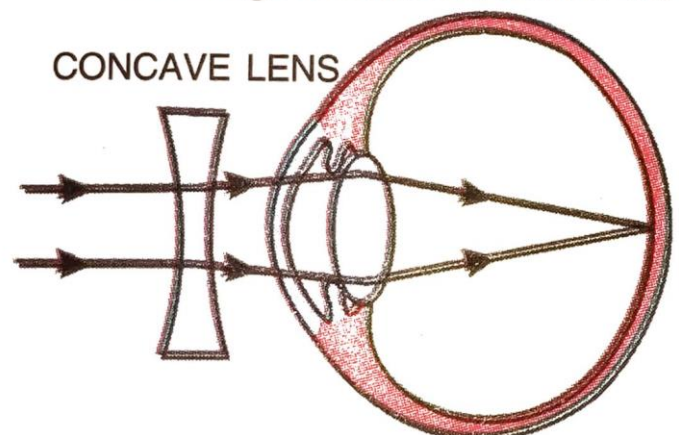
• The vitreous humour serves two functions:

(i) It helps in keeping the shape of the eyeball,

(ii) It protects the retina and its nerve endings.



The image is formed in front of the retina.



A concave lens diverges the light rays. As a result, the image is now formed on the retina

## COMMON DEFECTS OF THE EYE

**1) Near or short-sightedness (Myopia)** is a condition in

which the near objects can be seen clearly while the distant objects appear blurred.

### Reasons for myopia:

- (i) the eye ball is lengthened from front to back
- (ii) (ii) the lens is too curved (even both reasons may occur together).

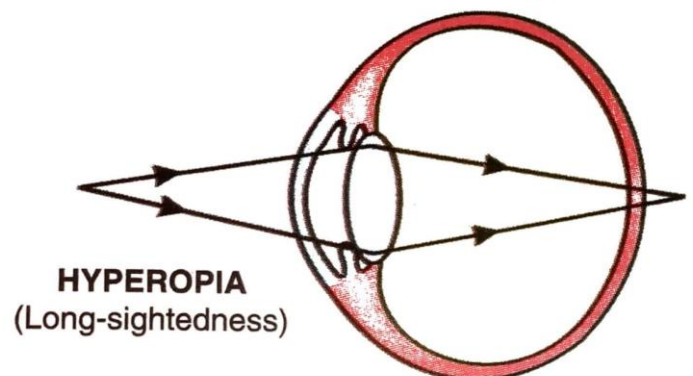
**Correction of myopia:** Suitable concave (diverging) lens. Power of glasses used is mentioned in minus "-".

### 2. Far or long-sightedness

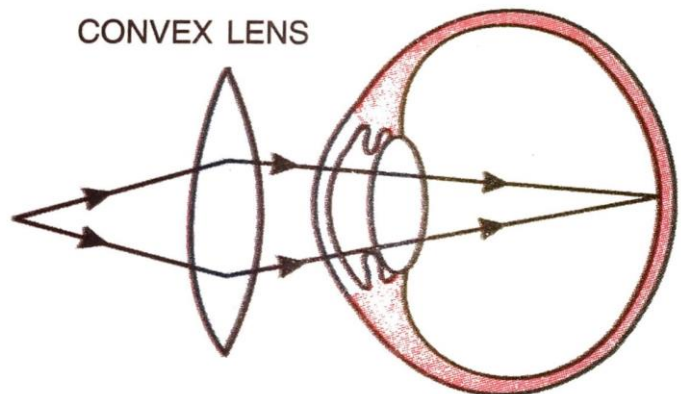
(**Hyperopia**, old term Hypermetropia) is a condition in which there is a difficulty in seeing near objects. In it, the image of near object falls behind the retina.

**Reasons for hyperopia:** This defect results on account of either shortening of the eyeball from front to back or the lens is too flat.

**Correction of hyperopia:** A convex (converging) lens is required to correct it (power of the glasses used is mentioned in plus "+").

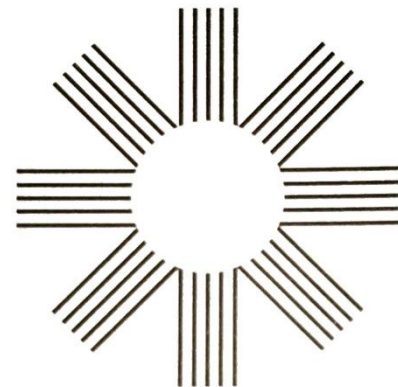


The image is formed behind the retina.



A convex lens converges the light rays. As a result, the image is now formed on the retina

**3. Astigmatism** is a defect in which some parts of the object are seen in focus while others are blurred. It arises due to the uneven curvature of the corneal This is corrected by **cylindrical lenses**.



**4. Presbyopia** is a condition affecting older people who cannot see near objects clearly. Their **lens loses flexibility** resulting in a kind of far sightedness. This again is corrected by a **convex lens**.

**5. Cataract** is a condition in which **the lens turns opaque** and the vision is cut down even to total blindness. It can be corrected by surgically removing the lens, and by using spectacles with highly convex lenses, compensating for the missing lens, or in a newer technique, a small plastic lens is implanted behind or in front of the iris.

**6. Night-blindness** is a condition in which a person feels difficulty in seeing in dim light as during the night. This is due to non-formation of the pigment visual purple of the rods. **Only rods function** in dim light and in the absence of the pigment, they cannot function. This is usually due to the **deficiency of vitamin A** which is required for the synthesis of the pigment.

**7. Colour blindness** is a condition in which some people by birth cannot discriminate between certain colours such as red and green. This is due to a genetic defect. Mostly males suffer from this defect, whereas it rarely occurs in females.

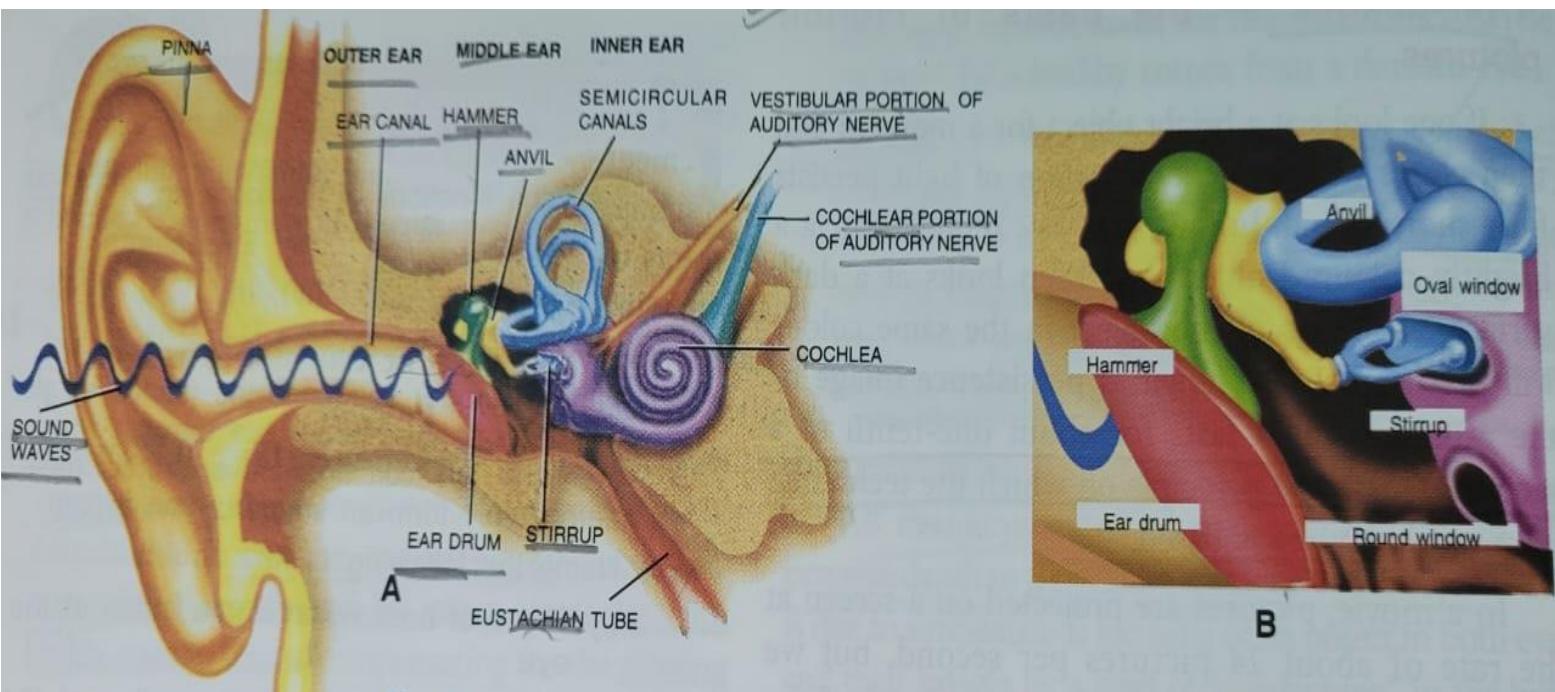
**8. Corneal opacities:** The cornea of some patients gets scarred and turns opaque (white) and non-functional. Such defects can cause anything from minor irritation to vision problems and even blindness. In such cases, the defective cornea can be replaced by a healthy cornea from a donated eye.

**9. Squint:** In this defect, the two eyes somewhat converge leading to what is called "**cross eye**". An opposite condition appears when they diverge and is called the "**wide eye.**" Both conditions may cause double vision or diplopia. (Surgery and suitable exercise can correct these defects.

## **THE EAR - ORGAN FOR HEARING AND BALANCE**

The human ear is concerned with two functions, hearing and body balance.

It has three main divisions: (i) outer ear, (ii) middle ear and (iii) inner ear.

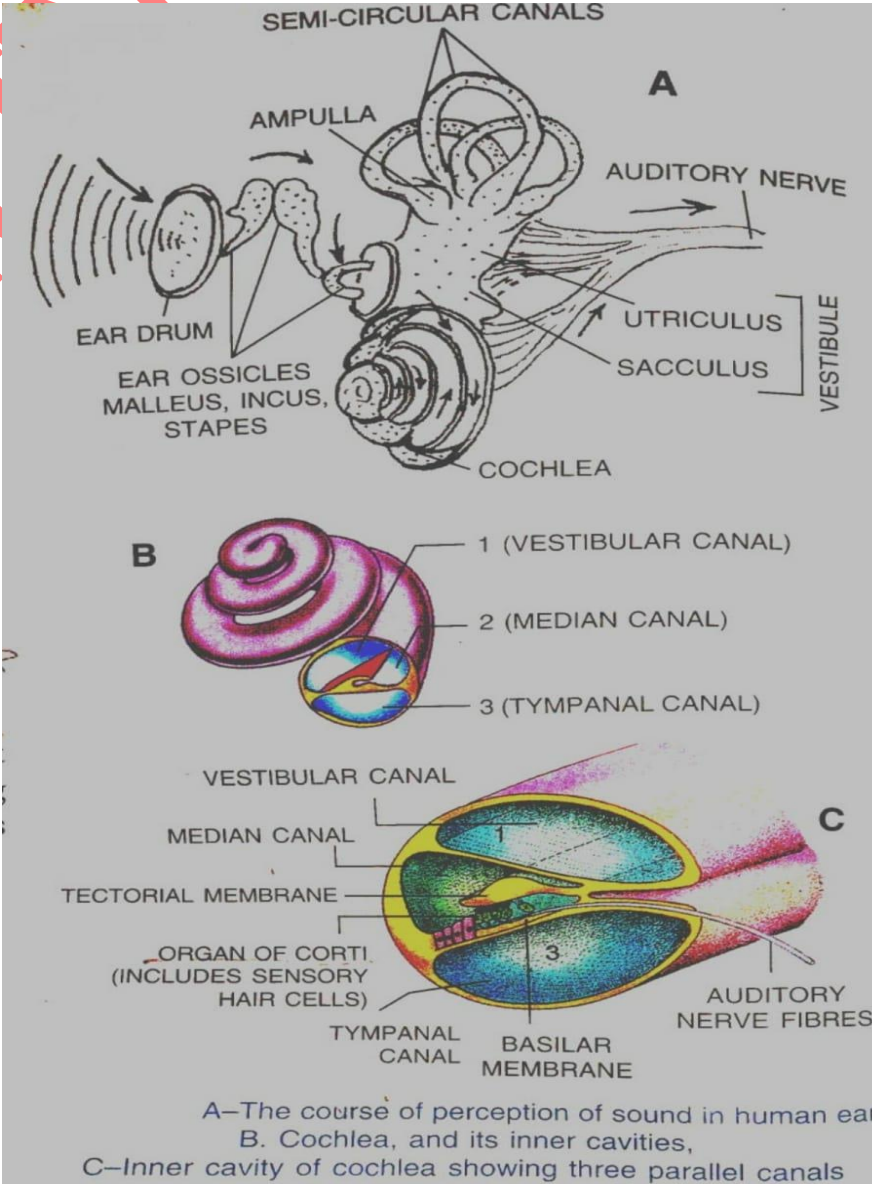


**(i) The outer ear** consists of the projecting part **pinna** and the passage auditory canal leading to the ear drum.

**(ii) The middle ear** contains three tiny bones malleus, incus and stapes or hammer, anvil and stirrup in popular terms and a eustachian tube which connects the cavity of the middle ear with the throat.

The three bones are collectively called the ear ossicles. The flat part of the stirrup fits on the so-called **oval window**, a membrane-covered opening leading to the inner ear, A second opening, the round window, also covered by a thin membrane, connects the middle and the inner ear.

**(iii) The inner ear** has three parts - the cochlea, semi-circular canals and the vestibule .



**The cochlea** is spiral-shaped and looks like **a snail shell**. It has three parallel canals separated by membranes. The median (cochlear) canal (2) is filled with a fluid called **endolymph** and the other two (1 and 3) with **perilymph**. The middle canal contains areas possessing sensory cells, spiral organ called **organ of Corti for hearing**. The nerve fibres arising from these cells join the auditory nerve. The sensory cells lie on the basilar membrane.

One end of semicircular canal is widened to form **an ampulla** which contains sensory cells **for dynamic balance** while the body is in motion

**Utriculus and a sacculus**, collectively termed as **vestibule** contain sensory cells for **static balance** when the body is stationary as in standing.

## **FUNCTIONS OF THE EAR**

The internal ear is involved in two sensory functions: Hearing and Body Balance.

### **A. HEARING**

The pinna collects the sound waves and conducts them through the external auditory canal. They finally strike on the ear drum which is set into vibration.

- The **eustachian tube** equalizes the air pressure on either side of the ear drum allowing it to vibrate freely.
- The **vibrating ear drum** also sets the three ossicles into vibration.
- The **vibration of the last ossicle** (stirrup) is amplified due to lever-like action of the first two ossicles.
- The vibrating stirrup transmits the vibration to the **membrane of the oval window** which in turn sets the fluid contained in the cochlear canals also into vibration.
- The vibrating movements of the fluid stimulate the hair-like processes of the sensory cells of the cochlea (in spiral organ) and the impulses are transmitted to the brain via the auditory nerve.

## **B. BALANCING**

**The sensory cells in the semi-circular canals are concerned with dynamic equilibrium i.e., while the body is in motion.**

**Utriculus and sacculus which register the static (positional) balance with respect to gravity.**

**SIR TAPUN RUPANI**